



## New institute to tackle exascale computing

Renowned supercomputing expert Pete Beckman has been named director of a newly created Exascale Technology and Computing Institute (ETCi) at the U.S. Department of Energy's (DOE) Argonne National Laboratory. Working with scientists and industrial partners from around the world, the ETCi will focus on developing exascale computing to extend scientific discovery and solve critical science and engineering problems.

Exascale computing represents the next generation of supercomputers, systems that will be 1,000 times more powerful than the Tianhe-1A—a supercomputer in China that was recently named the fastest in the world. Currently, computing speeds are measured in petaflops, representing a quadrillion operations per second. Exascale machines will be measured in exaflops, which are the equivalent of a quintillion, or one million trillion floating point operations per second.

These exascale supercomputers will be powerful enough to produce models of phenomena that are not possible with today's tools. They will be capable of generating large-scale simulations of worldwide climate change to things on a much smaller scale but also extraordinarily complex, like the functions that take place within a single human cell.

"Reaching exascale will require exciting new technologies and novel approaches to hardware and software development," said Rick Stevens, Argonne's associate laboratory director for computing, environment, and life sciences. "Pete's proven leadership and ability to deliver results will be key to harnessing the power of exascale and leading the community to produce unprecedented

opportunities for scientific discovery and technical innovations to power American industry."



*These high core count experimental chips from Intel could provide one path to exascale computing—in which computers would perform one quintillion operations per second.*

Prior to this new assignment, Beckman served as director of the Argonne Leadership Computing Facility (ALCF), a world-leading high-performance computing center located at the Argonne site outside of Chicago.

Argonne has a long history of achievement in high-performance computing, from developing advanced computational methods and open source

software used worldwide by thousands of scientists to deploying the world's largest platforms for the national scientific community, such as Intrepid, an IBM Blue Gene/P supercomputer and Magellan, a cloud computing platform for scientists.

But making exascale computing possible will require a concerted effort by the entire scientific computing community. Beckman and colleagues from other DOE laboratories and six universities were recently awarded funds to construct a plan for creating an Exascale Software Center that would develop the software for future exascale platforms.

“Supercomputing architectures are rapidly changing,” said Beckman. “New technology will necessitate transforming system software and applications to enable new scientific discovery at extreme scales. By using principles of co-design, computer scientists and applied mathematicians, industrial partners, and the scientists using today’s supercomputers can work together to make exascale computing a reality.”



*Argonne scientist Pete Beckman has been chosen to lead the Exascale Technology and Computing Institute (ETCI).*

Over the next 10 years, the community will work together to simultaneously address a number of daunting technical challenges, such as developing ultra-low power designs, 3-D chip configurations, massively parallel programming models, silicon photonics and hybrid multicore architectures.

“I am honored and excited to be a part of such an important initiative,” said Beckman. “Exascale computing will be critical in maintaining American competitiveness and our global leadership in high-performance computing. It

promises huge benefits in energy, environment, health and national security.”

Beckman is also co-chair of the International Exascale Software Project (IESP), co-funded by the National Science Foundation and DOE. Over the last two years, the IESP has organized the world’s top scientists to construct a roadmap for exascale software. The roadmap will be published in the January 2011 issue of the International Journal of High Performance Computing Applications.

During the past 20 years, Beckman has designed and built software and architectures for large-scale parallel and distributed computing systems. He joined Argonne in 2002 as director of engineering and chief architect for the TeraGrid, and in 2008 was named director of the ALCF. Under Beckman’s guidance, the ALCF successfully deployed the IBM Blue Gene/P system, one of the world’s fastest supercomputers, ahead of schedule.

Beckman has also worked in industry, founding a research laboratory in 2000 in Santa Fe, N.M., sponsored by Turbolinux Inc., which developed the world’s first dynamic provisioning system for large clusters and data centers. In 1997, Beckman joined the Advanced Computing Laboratory (ACL) at Los Alamos National Laboratory, where he founded the ACL’s Linux cluster team and was instrumental in catalyzing the high-performance Linux computing cluster community. He received a Ph.D. degree in computer science from Indiana University where he helped create the Extreme Computing Laboratory.

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